

THE JAPYGIDAE OF NORTH AMERICA 1—
PROVALLJAPYGINAE AND NANOJAPYX

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The subfamily Evalljapyginae is characterized by the five pectinate laminae of the lacinia and the bilateral asymmetry of the forceps, as well as other characters. Silvestri (1949) studied three specimens from the state of São Paulo, Brazil and noted that they possessed a falciform distal lamina on the lacinia and nearly bilaterally symmetrical forceps. He named this insect *Provalljapyx lanei* new genus and new species and placed it in the subfamily Evalljapyginae although it did not fit in the two characters mentioned. Paclt (1957) placed Silvestri's genus *Provalljapyx* as a synonym of *Evalljapyx* but, as indicated below, this is not justifiable.

In my collection are 63 specimens representing five species which I assign to the new genus *Nanojapyx*. This genus from California shows affiliation to Silvestri's genus *Provalljapyx* from Brazil. Neither of these genera can be placed logically in the subfamily Evalljapyginae. In my opinion they represent an evolutionary group between the Projapygidae and the Evalljapyginae, and I therefore place them in the new subfamily, Provalljapyginae. All of the Projapygidae known from the New World have plumose body setae and bilaterally symmetrical anal cerci which do not show sexual dimorphism. We may assume that the Projapygidae arose from a primitive campodeid by the shortening and thickening of the anal cerci, and later by the addition of stout spines mesad on the cerci as a defensive mechanism for protection against attack from the rear.

A further step in the evolution is represented by the Provalljapyginae wherein the anal cerci are modified into unsegmented forceps which are symmetrical and do not show sexual dimorphism. The final evolutionary step is exhibited by the Evalljapyginae wherein in the left forcep is different than the right forcep and the forceps of the male are different from those of the female. This line of evolution is also supported by anatomical features other than the forceps.

Provalljapyginae, new subfamily

Similar to the Evalljapyginae except: antennae with 20 to 23 segments, distal lamina of lacinia falciform, styli each with a

single seta, tergite VII slightly lobed or bilobed, pleura VII not heavily sclerotized or projected to the rear, forceps approximately similar and without sexual dimorphism, length of body 2 to 4 mm.

Inasmuch as this subfamily is now known from eastern South America and western North America, it seems probable that a rich fauna exists in this group. They have undoubtedly been overlooked by earlier collectors because of their small size and, if seen, they were probably mistaken as nymphal stages of larger species.

KEY TO THE GENERA

1. Stylus with a single seta, distal lamina of lacinia falciform, forceps similar (Provalljapyginae) 2
- Stylus with two setae, distal lamina of lacinia pectinate, forceps not bilaterally symmetrical (Evalljapyginae) 3
2. Two large median teeth on each forcep, no other teeth or denticles, posterior seta on pleuron plumose, segment X tergite setae 4 + 1 + 4.....*Provalljapyx*
- Four or more similar teeth on each forcep, posterior seta on pleuron simple, segment X tergite plumose setae 3 + 3.....*Nanojapyx*
3. Setose frontal sinus*Ctenjapyx*
- Without setose frontal sinus*Evalljapyx*

Nanojapyx L. Smith, new genus

Type species: *Nanojapyx pagesi* L. Smith, new species.

Head.—Antenna with 22 ± 1 segments; vertex covered with a number of M^1 and a lesser number of m ; distal half of antenna with segments showing two fairly regular rows of m , a a little more to the base than to the extremity of the segment, longer than m on the same segment; apical lamina of lacinia falciform, shorter than the other four, pectinate laminae. *Thorax*.—Pronotum $6 + 6$ M , meso- and metanotum 7 to 9 + 7 to 9 M ; legs, femora dorsal apex with two subequal small usually plumose setae and one simple seta in a line; tarsus with two ventral rows of spine-like setae, two or three setae per row. *Abdomen*.—Tergites with four to five irregular transverse rows of M , and fewer m , M with 6 ± 2 pinnulae; sternites with five irregular transverse rows of M and fewer m , M with 3 ± 2 pinnulae; tergite X with 3 + 3 plumose M between the carinae and a variable number of m ; lateral subcoxal organs broad with about four to seven plumose sensory setae each, in a single row, and two or three irregular rows of distinct glandular setae; styli on segments I–VII, each with one mesad seta, approximately one-third as long as the stylus; abdominal pleura; anterior pleurite with two large setae, with the anterior one plumose;

1 Abbreviations: M — macrosetae, plumose; m — sub-macrosetae, usually simple but occasionally plumose, a — dorsal sense-seta on the fourth antennal segment; L 1, L 2, L 3, — first, second, and third pair of legs; A, B, C, D — anterior, second, third, and posterior rows of M on the abdominal sclerites; I–X — abdominal segments.

pleuron with three large setae, posterior one simple; forceps apparently symmetrical, differing only in number of teeth, teeth usually sharp pointed, not rounded denticles; all setae on forceps simple, except one or two basal; no sexual dimorphism in forceps.

This genus is close to the genus *Provalljapyx* but can be distinguished from it by the presence of four or more teeth on each forcep.

***Nanojapyx pagesi* L. Smith, new species**

Female.—*Head*: antenna with 22 segments; segments 13 to 22 with all setae of same size, arranged in two transverse rows, about 16 setae in distal circle, and about 20 setae in basal circle; segment IV circled with eight to ten larger setae anterior to *a*; labrum with 7 + 7 simple setae of various sizes; mandible with three fused teeth and a fourth, distinct, less heavily sclerotized, pointed tooth; first tooth (ventral) of mandible largest and recurved at tip; galea of maxilla with sclerotized thumb at apex of anterior lobe with five spatulate projections at tip of thumb; palpus with ten simple setae; lacinia heavily sclerotized, arcuate, lamina 1 a rod, shorter than lamina 2; laminae 2 to 5, typical combs; labium with numerous simple setae; labial palpi short, conical, with two long and one short simple setae; dorsum of head with about 24 + 24 setae, mostly all plumose. *Thorax*.—Pronotum with 6 + 6 M and 5 + 4 m; mesonotum, prescutum with 1 + 1 M and 1 + 1 m; scutum with 7 + 8 M and 7 + 7 m; metanotum with 8 + 9 M; legs short, setae at dorsal apex of femur, numbers 1 and 2 plumose, number 3 simple, number 3 longer than number 1, number 2 shortest; large ventral setae on tarsus in two rows of two setae each, tarsal claws simple sub-equal. *Abdomen*.—Tergite I: prescutum with 1 + 1 M and 1 + 1 m, scutum with 6 + 6 M and 6 + 6 m; sternite I—prescutum with 4 + 5 M, and no m, scutum A = 4 + 4 M, B = 2 + 2 M and 2 + 2 m, C = 4 + 4 M, D = 9 + 9 M; lateral subcoxal organs with 7 + 7 M and numerous glandular setae arranged in two irregular rows; stylus simple, conical with slightly bulging base, one simple curved seta; tergite II, A = 4 + 4 M, B = 2 + 2 M, C = 2 M and 3 + 3 m alternating in row with M; segments III to VII inclusive similar to segment 2; six ventral setae associated with stylus VII, as illustrated, setae 1, 3, and 5 with 3 or 4 pinnulae, setae 2 and 4 present. Segment VIII width 0.16 mm, length 0.18 mm; tergite, A = 4 + 4 M and 1 + 1 m, B = 2 + 2 M and 1 + 1 m, C = 3 + 3 M and 3 + 3 m alternating in row with M; sternite, A = 3 + 3 M and 1 + 1 m, B = 3 + 3 M and 1 + 1 m, C = 3 + 3 M and 3 + 3 m; spermatheca between B and C, bulbous with a long anterior spike; genital opening with many simple setae, no palps. Segment IX tergite, 3 + 3 M and 3 + 3 m alternating; sternite with 3 + 3 M and 3 + 3 m; segment X, width 0.14 mm, length 0.20 mm; tergite, (between crenulae) A = 2 + 2 M, B = 1 + 1 M, C = 3 + 3 M of which the four mesad setae are simple, about six m scattered over the tergite; sternite A = 3 + 3 M followed by a row 2 + 2 m, B = 2 + 2 M and 1 + 1 m, C = 1 + 1 M, D = 3 + 3 M and 2 + 2 m; acropygidium distinct, rounded, edge crenulate; carinae distinct; forceps short and broad (as illustrated) and strongly bent upward toward

the tips; right forcep with seven sharp, recurved teeth, left forcep with five similar teeth, each forcep with ten large setae of which the outer, basal one is plumose; and nine smaller setae of which four arise near the dental margin; length of forcep 0.14 mm; length of body, including forceps 2.89 mm.

Male.—Similar to female except no spermathecae; large median internal setose sac opening ventrally on scutum III near the suture between the prescutum and scutum, tip of sac extending anteriorly to posterior margin of second urosternite, setae near the mouth of the sac plumose, the rest simple; lateral subcoxal organs with 6 + 6 plumose sense-setae and numerous hyaline glandular setae almost as long as the sense setae; right forcep with six teeth, left forcep with five teeth; length of body 2.72 mm.

Holotype female and allotype male (California Academy of Sciences) and paratype female and male (University of California, Davis) were collected in leaf mold NEAR OAKLAND, ALAMEDA COUNTY, CALIFORNIA, in January, 1953 by Mr. Robert O. Schuster.

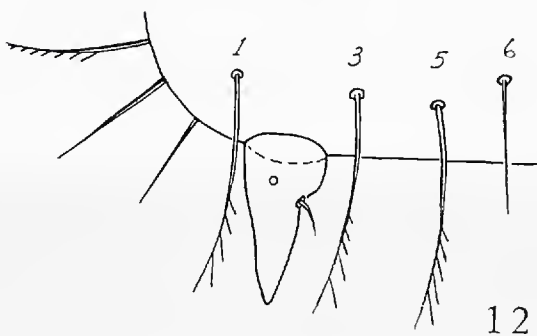
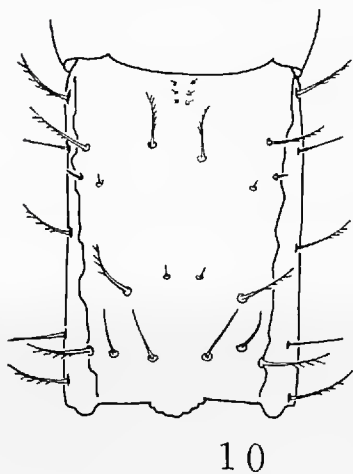
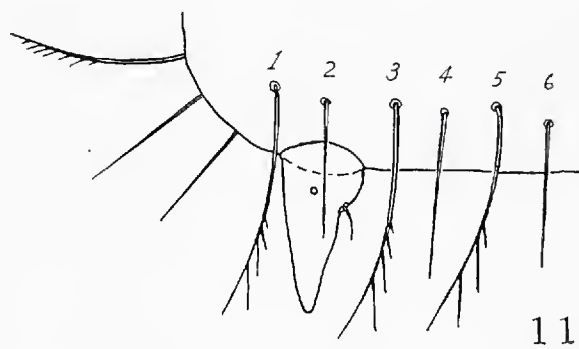
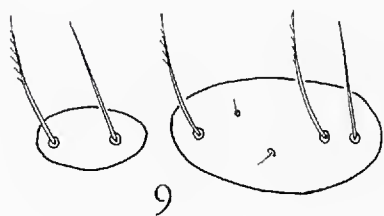
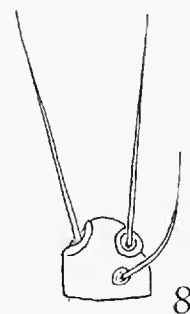
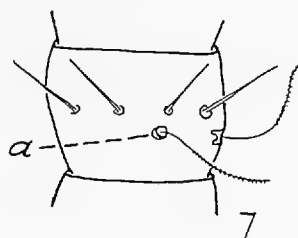
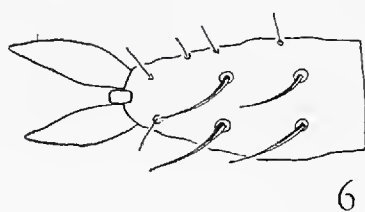
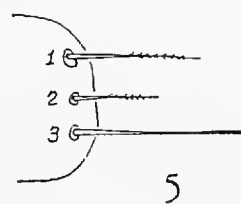
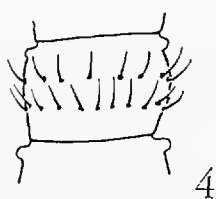
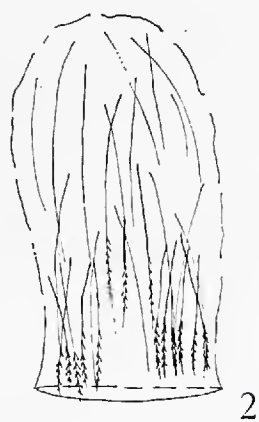
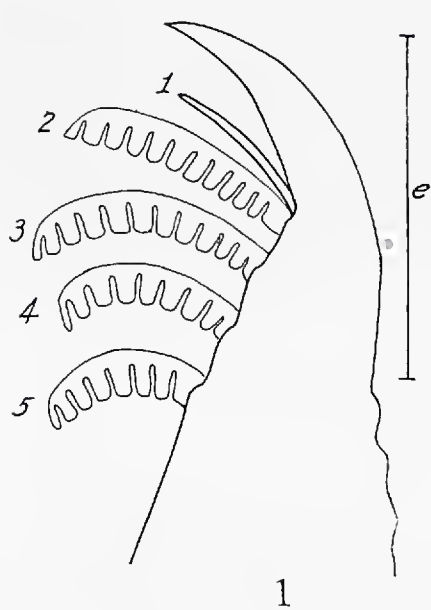
I take pleasure in naming this species after M. L. Pagés of the Laboratoire de Biologie Animale, Université de Dijon, France, in recognition of his fine work in the taxonomy of the Japygidae.

***Nanojapyx pricei* L. Smith, new species**

Female.—Similar to *N. pagesi* L. Smith except setae at dorsal apex of femora, number 3 equal in length to number 1; setae on labial palp 4; meso-and metanotum 8 + 8 M; setae number 1 on forceps usually simple or minutely plumose; length of forceps 0.18 mm; right forcep with seven teeth, left with six teeth; tips of forceps strongly curved inward, as illustrated; lateral subcoxal organs each with six or seven plumose sense setae; ventral setae associated with stylus VII as in *pagesi* but with three pinnulae each; abdominal segment X, width 0.20 mm, length 0.28 mm; length of body, including forceps 3.83 mm.

EXPLANATION OF FIGURES

Fig. 1, lacinia of *Nanojapyx pagesi* L. Smith showing rod-like structure of the first lamina, e = 0.05 mm; fig. 2, male sac in III of *pagesi* dorsal view, e = 0.05 mm; fig. 3, spermathecae of *pagesi* dorsal view; fig. 4, eighteenth antennal segment of *pagesi* female, dorsal view, e = 0.05 mm; fig. 5, apex of femur of *pagesi* dorsal view showing plumose setae 1 and 2, and simple seta number 3; fig. 6, tarsus of L 2 of *pagesi* ventral view showing two rows of two stout setae each, e = 0.05 mm; fig. 7, fourth antennal segment of *pagesi* female, dorsal view showing dorsal sense seta at a; fig. 8, labial palpus of *pagesi* female, ventral view; fig. 9, pleuron of left side of *pagesi* female showing setal pattern, left = pleurite, right = pleuron; fig. 10, tergite X of *pagesi* female, dorsal view, e = 0.10 mm; fig. 11, right stylus VII and associated setae of *pagesi*, ventral view, e = 0.05 mm; fig. 12, right stylus VII and associated setae of *N. gentilei* L. Smith ventral view, e = 0.05 mm.



Male.—Similar to female, except right forcep with six teeth, left with five teeth; male sac with few setae mostly simple, but nine setae show minute pinnulae near the opening of the sac; abdominal segment X, width 0.17 mm, length 0.22 mm; length of body including forceps 3.54 mm.

In addition to the six paratypes, I have examined a series of eight metatype adults from Sharp Park, San Mateo County, California. In some of these the females lack the basal tooth on the right forcep.

Holotype female and allotype male (California Academy of Sciences), and 18 paratypes (California Insect Survey; University of California, Davis; U.S. National Museum) were collected in chaparral leaf mold in the SAN BRUNO MOUNTAINS, SAN MATEO COUNTY, CALIFORNIA, in January, 1957.

I take pleasure in naming this species after Mr. Douglas W. Price who collected it.

***Nanojapyx gentilei* L. Smith, new species**

Female.—Similar to *N. pagesi* L. Smith except setae at dorsal apex of femora, number 3 longer than number 1, number 2 shortest and not plumose; setae on labial palp 4, setae on maxillary palp 7; meso- and metanotum 7 + 8 M; seta number 1 on forceps minutely plumose; length of forceps 0.12 mm; right forcep with six teeth, left with five teeth, tips of forceps strongly curved inwards; lateral subcoxal organs each with four or five plumose sense setae; ventral setae associated with stylus VII as illustrated with setae number 2 and 4 missing; abdominal segment X, width 0.11 mm, length 0.16 mm; length of body including forceps 2.72 mm.

Male.—Unknown.

Holotype female (California Academy of Sciences), paratype female and juvenile (University of California, Davis) were collected ten to twelve inches deep in sandy soil in a growth of poison oak by L. M. Smith and R. O. Schuster near TRENTON, SONOMA COUNTY, CALIFORNIA, on August 7, 1957.

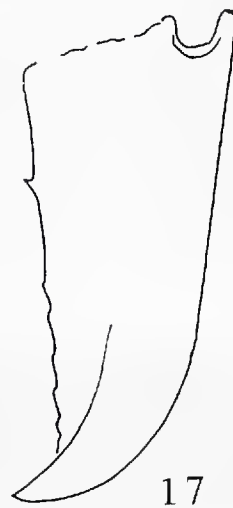
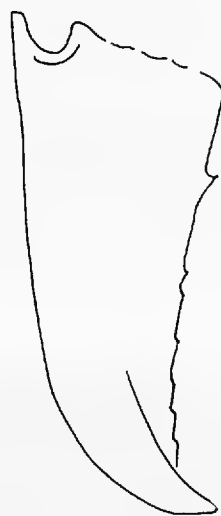
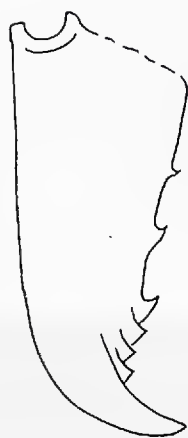
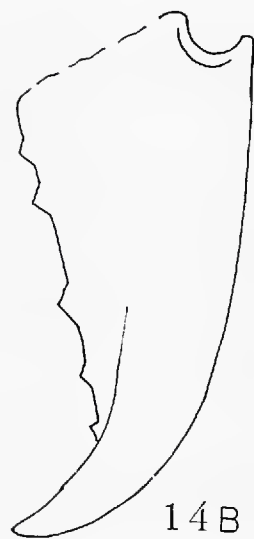
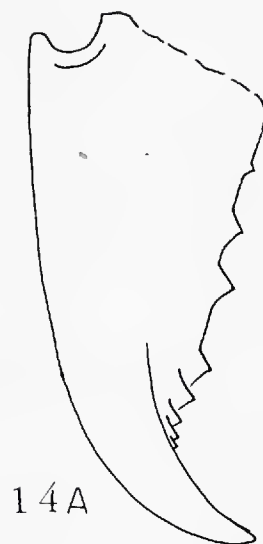
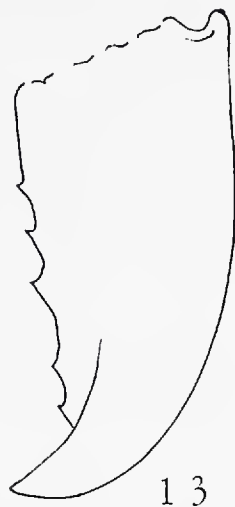
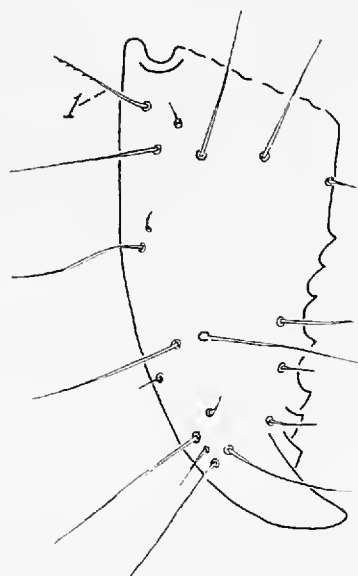
I take pleasure in naming this species for Mr. Adriano Gentile who has been of great assistance to me by translating Silvestri's works on Japygidae from Latin.

***Nanojapyx hamoni* L. Smith, new species**

Female.—Similar to *N. pagesi* L. Smith except setae at dorsal apex of femora, numbers 1 and 2 plumose, with number 3 equal in length to number 1; setae on labial palp 4, setae on maxillary palp 7 + 8; ventral

EXPLANATION OF FIGURES

Forceps of *Nanojapyx* females, dorsal view, reversed left to right, setal pattern of all as shown in fig. 13. All figures at same magnification, e = 0.10 mm. Fig. 13, *pagesi*; fig. 14, *hamoni*, a, right, and b, left forcep; fig. 15, *pricei*; fig. 16, *gentilei*; fig. 17, *coalingae*.



setae per row on tarsus $3 + 3$; meso- and metanotum $7 + 7$ M; seta number 1 on forceps minutely plumose; length of forcep 0.14 mm; left forcep with eight teeth with distal tooth almost hidden, right forcep with five teeth, all teeth pyramidal in shape, not recurved; lateral subcoxal organ with $6 + 6$ plumose sensory setae; ventral setae associated with stylus VII with setae 2 and 4 present, these become progressively smaller anteriorly, setae 1, 3, and 5 with 4 pinnulae each; segment X, width 0.19 mm, length 0.22 mm; length of body including forceps 3.40 mm.

Male.—Unknown.

Holotype female (California Academy of Sciences) collected in redwood leaf mold near HALF MOON BAY, SAN MATEO COUNTY, CALIFORNIA on July 21, 1957 by Mr. R. O. Schuster. Three female paratypes were collected in clay-loam soil and humus under Monterey Cypress, by W. H. Lange and R. Schoeppner at Wolf Ranch, San Mateo County, California, April 24, 1958 and are deposited in the collection of the U.S. National Museum, California Insect Survey and the University of California, Davis.

Nanojapyx coalingae L. Smith, new species

Female. Similar to *N. pagesi* L. Smith except antenna with 23 segments; antennal segment 18 with eight setae in the distal whorl; setae at dorsal apex of femora, numbers 1 and 2 plumose with number 1 equal in length to number 3; setae on labial palp 3, setae on maxillary palp 8; meso- and metanotum $7 + 7$ M; ventral setae per row on tarsus L 1 = $2 + 2$; L 2 and L 3 = $3 + 3$; seta number 1 on forceps clearly plumose; tergum X setae between carinae, row A as in *pagesi*, the two pair of m posterior to A strongly developed, row B anterior of middle, C irregular, with one additional pair of m just mesad of the lateral setae, median pair of M posterior, simple, all other M plumose; length of forceps 0.14 mm, right forcep with one distinct sharp pointed recurved tooth and crenulations suggesting remnants of six teeth, left forcep the same; lateral subcoxal organ with $6 + 7$ plumose sensory setae; ventral setae associated with stylus VII, seta number 2 present but small, and seta 4 absent; setae 1, 3, and 5 with four or five pinnulae; segment X width 0.14 mm, length 0.20 mm; length of body including forceps 3.06 mm.

Male.—Unknown.

Holotype female (California Academy of Sciences) was collected in juniper leaf mold NEAR COALINGA, FRESNO COUNTY, CALIFORNIA on January 22, 1958, by Mr. H. L. Wilson.

KEY TO THE SPECIES OF NANOJAPYX L. SMITH

1. Antennae with 23 segments.....*coalingae*
- Antennae with 22 segments..... 2
2. Three setae per row on tarsus.....*hamoni*
- Two setae per row on tarsus (fig. 6)..... 3
3. Three setae on labial palpus (fig. 8).....*pagesi*
- Four setae on labial palpus..... 4

4. Plumose seta at apex of femur shorter than adjacent simple seta
 (fig. 5)*gentilei*
— Plumose seta at apex of femur same length as adjacent simple
 seta*pricei*

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RELEASES OF RECENTLY IMPORTED INSECT PARASITES
AND PREDATORS IN CALIFORNIA, 1956-57

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The following list, reporting the first field releases of certain imported species of parasites and predators by the Department of Biological Control, supplements two preceding reports,^{1,2} covering the years 1952-53 and 1954-55. The year of first release is 1957 unless otherwise indicated.

The species listed in the 1952-53 report as *Platynaspis* (?) sp. has since been identified as *Exochomus metallicus* Korschefsky.

| <i>Host and Parasites or Predators</i> | <i>Origin</i> | <i>Area or County of Release</i> |
|---|---------------|----------------------------------|
| SAISSETIA OLEAE (Bern.) | | |
| <i>Coccophagus mexicensis</i> Gir.* | Mexico | So. Calif., Tulare |
| <i>Mesopeltis atrocyanea</i> Masi | Mexico | San Diego |
| <i>Metaphycus lichtensiae</i> (How.) | Pakistan | Coastal So. Calif. |
| <i>Microterys consobrinus</i> Comp.* | Mexico | San Diego |
| <i>Microterys flavus</i> (How.) (Black scale race) | India | So. Calif. |
| AONIDIELLA AURANTII (Mask.) | | |
| <i>Aphytis</i> sp. (Burma) | Burma | So. Calif. |
| <i>Aphytis</i> sp. (India) | India | So. Calif. |
| <i>Aphytis</i> sp. (Pakistan) | Pakistan | So. Calif. |
| <i>Chilocorus tristis</i> Fald. ³ | Japan | San Diego San Bernardino |
| <i>Cybocephalus</i> sp. | India | So. Calif. |
| <i>Pharoscymnus</i> sp. | India | San Diego |